**Multi-scale Modeling and Optimization of Cardiovascular Systems**

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**Abstract:**

Heart disease is the leading cause of death in U.S. and in the world. A significant amount of research effort (e.g., biological experiments) has been made to investigate cardiac pathologies and to discover scientific knowledge for improving the efficiency and quality of cardiac care. However, biological and clinical experiments are not always feasible due to practical and ethical limitations. Computer modeling and simulation has become a crucial tool for virtual experiments, which can provide valuable insights into biological systems that are difficult to discover with physical experiments alone. This talk presents multi-scale computer models of cardiac electrophysiology to investigate disease-altered cardiac electrical dynamics. In particular, models across different organizational levels of ion channels, cells, and tissues are developed. In addition, cardiac models often involve different sources of uncertainty due to measurement errors and physiological variability. It is important to quantify such uncertainty to obtain more accurate model predictions. Our work quantifies parameter uncertainty in cardiac models at the ion channel level using in-vitro data, and further propagates the uncertainty onto higher organizations level of cell and tissue. The resulting cardiac models are used in different applications to investigate cardiac disease mechanisms and therapeutical designs. This research provides a unique opportunity to search the optimal outcomes with the "virtual" heart, as opposed to traditional experience-based subjective decisions.

**Biography:**

Dongping Du received her B.S. and M.S. degrees in Electrical Engineering from China University of Mining and Technology Beijing, China, in 2008 and 2010, and the M.S. and Ph.D. degrees in Industrial Engineering from the University of South Florida, Tampa, FL, in 2012 and 2015. Her research interests include computer simulation and optimization, biomedical informatics and computational cardiology, data analytics and image analysis, complex systems modeling and control, with applications in healthcare and bio-manufacturing. Dr. Du has received one best paper award from IEEE EMBC, and two of her papers were selected as Featured Article by Journal of IEEE Biomedical and Health Informatics. She served as track chairs for the Computer Information Systems division, and the Modeling and Simulation division in the IISE Annual Conference in 2016 and 2017.

